THE INSTITUTE OF PHYSICS

47 BELGRAVE SQUARE, LONDON, S.W.1

BULLETIN

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NOTICES TO MEMBERS

Yorkshire Branch

Following a formal request signed by Professor W. Sucksmith, Professor E. C. Stoner, Dr. A. B. D. Cassie, Dr. D. L. Smare, Mr. J. E. Gould, Dr. M. McCaig and Dr. R. S. Tebble, the Board has authorized the formation of a Yorkshire Branch of the Institute. Dr. Tebble has been acting as secretary of a small committee of Yorkshire members which has investigated the likely support for a new Branch. Arrangements will be made for a meeting of all members in Yorkshire to elect a Chairman (who will have a seat on the Board), an Honorary Secretary and a Branch Committee.

The boundary of the new Branch is not yet finally fixed although it will approximate to the county boundary. Members living near the proposed boundary will be asked whether they would find it more convenient to belong to the new Branch or to remain in the Branch to which they now belong (Manchester or North-Eastern).

40th Anniversary of the discovery of X-ray Diffraction

To celebrate the 40th anniversary of the discovery of X-ray diffraction the X-ray Analysis Group of the Institute is holding a Conference at the Royal Institution, London, on October 24th and 25th of this year. The meetings will take place during the afternoon of the 24th and the morning of the 25th, and there will be a dinner on the evening of the 24th at which the guest of honour will be Professor Max von Laue. Professor von Laue is the Honorary President of the International Union of Crystallography, and it is hoped that the Executive President, Professor J. M. Bijvoet, will also be present.

The scientific meeting will be opened by Professor Sir Lawrence Bragg, with a historical survey of the subject; and survey papers will be given by him and by Professor J. D. Bernal, Dr. D. Hodgkin and Professor G. V. Raynor. Further details may be obtained from the Honorary Conference Secretary, Dr. J. Thewlis, A.E.R.E., Harwell, Berks.

Reports on New Scientific Instruments

The Board has noted with pleasure that some Committees of Groups have been active in drawing up "user specifications" which give guidance about the design of "ideal" instruments of special interest to them. It is, of course, realized that in practice it is not always possible to produce commercial instruments which conform exactly with such specifications, but the Board appreciates the great value of these specifications to instrument makers and users and wishes to encourage this work.

These specifications have already led to the commercial production of prototype instruments on which individual members of the Groups have prepared confidential reports, comparing their design and performance with the "ideal" specification. After careful consideration, the Board has decided that such reports shall only be made available as confidential documents to members of The Institute of Physics on the clear understanding that the responsibility for the statements contained in them attaches only to the writers and that they are not writing on behalf of any Group or section of the Institute or the Institute as a whole.

While reproduction of the reports in whole or in part will not be sanctioned by the Board of the Institute, nothing need prevent a member issuing a report on an instrument in his private consultative capacity if so requested, provided he does not contravene the rules governing professional conduct.

In cases of uncertainty in the interpretation of this decision, the Officers of the Institute may be consulted.

North-Eastern Branch Summer Meeting

The North-Eastern Branch Committee had hoped to arrange a summer meeting in Durham City. It has not been possible to do so but members of the Branch are asked to note that a meeting will be held in Durham at a later date.

THE ORGANIZATION OF A DEVELOPMENT DEPARTMENT

The following is a shortened version of a talk given to the Midland Branch of the Institute by the late Dr. W. Wilson, F.Inst.P.

INTRODUCTION

Development is that form of research which is concerned with products that can be manufactured for public use. It is therefore the last stage in the process of evolving a new article, the development worker typically taking the result of a more fundamental investigation as his starting-point, and finishing with the production of a working and tested prototype ready for the works designers and draughtsmen. In the case of the more elaborate products, there are usually two previous stages; the first being pure research, carried out typically in a University laboratory, for the advancement of science in general, and the second a long-term investigation in an industrial research laboratory, with the aim of finding knowledge that will be useful to the industry in question.

It is frequently stated that the need for the development stage has been greatly under-rated by British manufacturers in the past, in comparison with their Continental and Transatlantic competitors. In the author's opinion, this has been the case, and justifies the attention now being given to the subject.

The laboratory to which the author will refer for most of his examples (the Witton Development Laboratory of the General Electric Co. Ltd.) should be of interest on account of the large dependence of its work on pure and applied physics. It provides the scientific service required by twelve factories engaged in heavy electrical engineering manufacturing, comprising turbo-alternators up to 60 000 kVA, large motors and generators, standard motors (50 to 200 h.p.), small motors (1 to 50 h.p.), fractional h.p. machines (below 1 h.p.), switch and control gear, high-voltage gear, transformers, electrically operated lifting magnets and hoists, lamp-black, dry batteries and moulded insulation. To compass so varied a range, the work of the laboratory must be equally varied; some of it, such as the high-voltage test room and the oscillograph section, consisting of pure physics, while other sections, such as the high-power testing station and the d.c. short-circuit test, involve a large element of engineering in their design and operation. As with the majority of industries today, a considerable element of pure and applied chemistry is also present.

2. FUNCTION AND ADVANTAGES OF A DEVELOPMENT DEPARTMENT

The chief function of an industrial research department has been defined as the evolution of new products or processes for manufacture in the industry or factory concerned; and this definition holds good for development.

As regards the relations between the laboratory and the works designers, there is no suggestion that the scientific talent of a concern shall be concentrated in the former. Skilful designers and engineers are required in the factory, and they are expected to make use of their initiative and ingenuity to the full. Occasions, however, occur at intervals when they encounter unusual obstacles. Problems arise which involve a special scientific study, such as the use of advanced mathematics; or certain proposed steps may require experimental verification. An idea may require investigation, or a new scheme or apparatus may be required. All such tasks require to be effected by special men who have had special training and are provided with special plant; and these are supplied by the laboratory. The more cordial the relations between laboratory and works, the more effective is the transfer of useful knowledge from one to the other.

A practical advantage derived from the services of a laboratory is that through the removal of so much non-standard work (as it may be termed) from the production departments, these are enabled to operate far more smoothly and continuously than otherwise.

3. STAFF ORGANIZATION

When the organization of a research staff is being considered, the aim should be to enable each member to work to the best advantage as part of the whole structure, in spite of each having his own individual characteristics. Hence flexibility is essential, in order that the scheme may readily be changed as far as its details are concerned to suit the peculiarities of a new member of the staff, or of an old member who it is found can be employed to greater advantage.

A further requirement is intimacy. Many problems depend for their solution upon more than one branch of science, while others can be much more effectively attacked when experience from more than one field of work is brought to bear on them. A great advantage that can be derived from the association of a group of men who have had diverse training and experience is the ability to concentrate a number of widely different minds upon a problem. Anything that impedes this interchange should be carefully avoided; such as over-organization or excessive departmentalism.

The scheme should therefore be just sufficient to provide the necessary supervision at all levels, in order to ensure that the work of each member is directed in the right course, and in particular that the problems attempted are brought to their conclusion before fresh work is undertaken. Roman armies were organized on the principle that one man could supervise ten subordinates; but it is generally agreed that for research work (including development), the maximum number of workers that should be put under a single leader should not exceed six or seven.

For a small staff of, say, 6 to 12, there is hence no need for any special organization at all, since all would be well known to their chief, and some would be juniors working under older members. A larger staff, such as that of the Witton Development Laboratory consisting of 135 men and women under a Laboratory Manager and his assistant, requires a ranking scheme.

At Witton the whole subject of heavy electrical engineering is divided up into nine science departments, each with its own head; and to them are added a model-shop and general office. These departments are themselves divided into a total of 38 sections, under leaders responsible to their respective heads.

It is inevitable that the work of some sections should overlap, and it is an advantage that they should do so, for opportunities are thus provided for collaboration in the shape of mutual discussion and help. When problems arise which concern more than one department, a further opportunity occurs for co-operation. Provided that the right atmosphere exists, the workers interested will quite naturally wish to pool their ideas, and in any case it is the manager's responsibility to ensure that the correct liaison exists.

A few words should be said with regard to the division of duties between the manager and his assistant. While the former is, of course, responsible for the whole of the enterprise, his chief concern is with the scientific and business side. If he were also to look after all the details of finance, staff-engagement, personnel, and similar internal matters, his more important work would inevitably suffer, and it is very necessary that he should have an assistant to relieve him of administrative details.

A special feature of a development laboratory is its close connection with the work of the factory. For this reason it must almost inevitably be located on or adjacent to the site of the works. There should be nothing in the organization to hinder the closest approach between the development and works' staffs, and a free interchange of visits should be encouraged.

As a means of bringing about the contacts visualized above, purely personal discussions are supplemented by formal meetings; but a word of warning is necessary as to the danger of overdoing this policy. It is only too easy to institute sets of meetings occurring at regular fixed times and absorbing a considerable proportion of the staff's time,

without any adequate gain. Such meetings are apt to give the illusion of progress without the reality, and can be very wasteful of man-power; and it should be realized that of all the steps that can be taken in a laboratory, talking can easily be the most expensive. In general, therefore, a series of meetings should only be called to discuss a specific problem, and they should be discontinued as soon as their purpose is completed.

Examples of such gatherings are (*a*) progress meetings, which are intended to make certain that all concerned in some important development project are marching in step; (*b*) liaison meetings, for securing co-operation between the laboratory and some branch of the works, such as the designers or the sales department; and (*c*) special meetings to decide upon steps to be taken for some fresh requirement or emergency, either of an administrative or a technical nature.

There are, however, two types of gathering that require to be held regularly, viz. management and senior-staff gatherings. With regard to the former, most laboratories of this description are supervised by a monthly committee convened by a director of the company and including the heads of the principal manufacturing interests served. The second might be termed a "semi-social" meeting, and its holding is more a matter of opinion. Its principal object is to cultivate the "family atmosphere" which can do so much to make things go smoothly, though the occasion is preferably a technical discussion. The author's practice is for the senior men to meet in his office for not more than an hour once a month, usually to hear one of their number describe a successful project which he has recently completed. The meeting incidentally affords an opportunity of raising any administrative matters that concern all the departments.

In addition to internal co-operation, it is most important that close contact be maintained with relevant outside research institutions. In the case of the Witton Development Laboratory, liaison is secured by interchange of visits, committee representatives and services, with the Company's Research Laboratories, Wembley (their chief centre for fundamental research), with the Electrical Research Association, and also, less closely, with laboratories engaged upon products allied with electrical engineering.

In conclusion, one of the great objectives of any research organization scheme should be mentioned, viz. the maintenance of enthusiasm among the staff. Anything that will hinder this end, such as "red tape," a too rigid organization, or frustration, must be especially avoided.

4. TRAINING AND SELECTION OF STAFF

Research has been defined with a good deal of truth as trial and error carried on under scientific conditions. It would therefore follow that research is not capable of being taught, a conclusion with which most authorities are in agreement. Dr. C. E. K. Mees, for example, has stated that "Scientists know how to conduct scientific research; if they don't, they are not scientists." They cannot, however, become men of science without education; and also would be expected to possess an initial aptitude for this work. In order to decide the question of selection and training, it will be worth while to consider the qualities required in a research worker. These will be divided into two groups; first, the general requirements for work in a laboratory, and, secondly, those which determine the individual's progress and the position which he can attain in the organization.

Group I

1. Keenness—to be of real use he must be interested in his subject.
2. Experimental mind—he must possess the creative impulse.
3. Critical faculty and intellectual honesty.
4. Urge for improvement and for obtaining the best possible results.
5. Enterprise—a liking for taking the difficult path.
6. Persistence—willingness to keep on trying till the solution is obtained.
7. Planning ability—including imagination, judgment, and ability to distinguish between cause and effect.

Group II

1. Initiative.
2. Personality.
3. Experience.
4. Technical knowledge.

Keenness has been placed first of all the requirements, since a research worker is of very limited value unless he is wrapped up in his subject. The second and fourth qualities in Group I are specially needed by development workers; while the third, the faculty of getting down to root principles, and a willingness to face the facts squarely, is of very great importance. But probably the fifth and sixth are the most unusual qualities and indicate most clearly that research demands an unusual type of man; just as mountaineers or explorers are unusual as compared with the much more numerous travellers who prefer the smooth and charted road.

The first group, then, specifies the nature of the man, i.e. the raw material, and the second how he should be trained; for although initiative and personality are to a certain extent inherent, yet they can be greatly encouraged and developed by education and experience. Under the heading of technical or scientific knowledge is included instruction in the branches of science with which he will have to deal; and it is in the study of these that he will learn to play his part as an investigator. A knowledge of the steps which have led to the great discoveries of the past and of the methods whereby such quantities as the specific heats, latent heats, and mechanical equivalent were first accurately measured, provides a most valuable course of lessons in the tactics of research, and a graphic series of practical examples for the future research worker to follow. Further, the study of mathematics is beneficial in developing his reasoning faculties.

A degree course in pure or applied science, or its equivalent, is thus indicated. There is no doubt that a full-time course at a university forms the best possible means, not only of acquiring the essential knowledge but of developing both personality and initiative through participation in the everyday life of such an institution. The author would like to stress the great advantage to be derived from the practice, almost universal among engineering students, of spending at least two months of the long vacations gaining practical works experience. Not only will this be complementary to the academic instruction, rendering the latter more interesting and hence easier to assimilate, but it will enable the graduate to make a flying start when he enters his profession in real earnest.

It is important to recognize that the real object of education is not to provide a stock of knowledge for the whole of one's career, but to inculcate the ability to acquire knowledge; and it follows that the exact subjects taken in the course do

not matter as much as is sometimes thought. In particular, for those who are so fortunate as to remain for a post-graduate course, the subject selected for a thesis is not of great moment in comparison with the manner in which it is handled. A further conclusion is that a creative worker's education is never finished, and in particular a research worker remains a student all his life. Universities, colleges and professional bodies recognize this nowadays by organizing extension and refresher courses suitable for staff members of all grades and ages, a provision which is of great value and is widely appreciated.

Although a full-time university course has been prescribed, it is not possible to draw all the staff from this source. For one thing, there are not at present enough graduates to go round, while men are required to fill junior positions. For the highest ranks, the ideal would be an honours degree followed by one or two years of post-graduate research; but not every graduate is in a position to obtain the latter. Since the work at an industrial laboratory is not greatly different from research work at a university, a graduate without college research experience will nevertheless be acceptable and can complete his qualification after entering industry. It should be emphasized that the chief requirement is not so much the length of his stay at the university, as his being trained by instructors who are research-minded.

Finally, nothing that has been said above will prevent a man of the right stamp from rising to a prominent position in industrial research, even if he has started work immediately after leaving school and taken, for example, a Higher National Certificate by means of five years' part-time study; although his path to fame will undoubtedly be more difficult than that of the university graduate.

NEW BOOKS

Life on Other Worlds. By Sir HAROLD SPENCER JONES, F.R.S. (London: English Universities Press, Ltd.) Pp. xi + 259. Price 12*s*. 6*d*.

This is the second edition of the book published in 1940. There are no major modifications, but the Astronomer Royal has taken the opportunity of incorporating certain additional information which has been obtained since that date, as, for example, that relating to planetary atmospheres, and of referring to more recent theories of the evolution of the solar system.

The treatment of the subject suggests that it is addressed to the layman, but the scientific content is so extensive that in spite of the lucidity of the presentation few laymen can be expected to follow the author's argument in its entirety. But any scientist, and any physicist in particular, will find the book of absorbing interest. It is a notable effort to build a solid pier of knowledge as far as possible out into the ocean of speculation, and the reader should have no difficulty in recognizing the frontier between fact and fancy.

Although one cannot question the author's main conclusions one cannot help feeling that he is sometimes a little dogmatic in his statements about matters which are not at present susceptible of direct investigation. Thus, for example, he implies (p. 246) that ammonia and methane are summarily poisonous to any conceivable form of life, yet it is known that certain bacteria flourish in concentrated sulphuric acid. Again, he discusses (p. 213) the possibility of our ever seeing planets belonging to other stars, or of discovering whether there are intelligent beings elsewhere in the universe. He is probably right, but history suggests that it is wise to refrain from negative predictions of this kind. Did not an eminent astronomer once declare, just before the foundation of spectroscopy, that it would never be possible to discover the composition of the stars? Sir Harold is also pessimistic in regard to the exposure of the astronaut to meteoritic bombardment. He points out that the lunar explorer would run a considerable risk of being hit and we are, of course, prepared to accept his statement, but it would be of interest to know just how great this risk is.

It is only with diffidence that one mentions such trivial points. The Astronomer Royal may care to consider them when preparing a new edition, but meanwhile the manifold merits of the book will commend it to a wide variety of readers, none of whom will fail to derive instruction, in most palatable form, from its pages. W. E. CURTIS

Modern Cosmology and the Christian Idea of God. By E. A. MILNE. (Oxford: The Clarendon Press.) Pp. 160. Price 21*s*.

Professor Milne was to have given the Edward Cadbury lectures in the University of Birmingham in 1950. To the great loss of the world of mathematical physics he died suddenly in September, 1950, and the lectures were not delivered. They were, however, complete and are here published essentially as he left them.

They contain little about Christian theology, being devoted mainly to modern cosmology and in particular to Milne's own theories and researches. Those familiar with his Kinematic Relativity and other writings will be specially interested in Chapter IX of the present volume where he expounds the last work he did, including a possible connection between magnetism and gravitation as well as a revision of his dynamical theory of light.

The rest of the book contains little or no mathematics but the reader has to grapple with much discussion of time-keeping in the universe and the many novel and amazing consequences of simple kinematics. It is found, for instance, that the constant of gravitation and Planck's constant are variable with the epoch "and our posterity will ultimately assign increased value to these so-called constants." The significance attached to the point-singularity $t = 0$, which is considered as "creation," is a recurring theme.

The first two chapters are specially interesting. They are, of course, fundamental to the rest of the book, but they will be appreciated by some readers who might find the later chapters difficult. Here Milne discusses the problem of the origin of laws of nature and adopts a point of view about scientific laws very different from that accepted by many scientists.

In the last chapter Milne turns to the second law of thermodynamics, and contests the conclusion about the "heat-death" of the Universe that was made familiar to a wide audience years ago by Jeans and others. He argues convincingly that we cannot make valid propositions about the entropy of *all* the bodies in the universe. The later references to religion are somewhat disappointing, especially in contrast with the insight and originality so evident throughout.

J. TOPPING

Applied Statistics, Vol. I, No. 1 (March 1952). (London: Oliver and Boyd Ltd.) Pp. 80. Price 10*s.* single number, 25*s.* annual subscription.

This new journal, to be issued three times a year, is published for the Royal Statistical Society and is intended to meet the needs of all who are interested in the applications of statistical methods, whether professional statisticians or not.

The main article of this first number is "The Introduction of Statistical Methods to Industry," by Dr. B. P. Dudding. It describes the pioneer work of Dr. Dudding and his colleagues in the Research Laboratories of the General Electric Co. Ltd., over more than 30 years, in introducing statistical techniques, particularly control charts, to the control of industrial processes. It contains, too, much wise comment on human problems arising from the introduction of changes in industrial methods.

Other articles include a survey of the proceedings of the 1951 International Management Congress, and papers on the specification of plastics, factor analysis and the accuracy of systematic sampling from conveyor belts. Finally, there is a paper by Mr. L. T. Wilkins on "Estimating the Social Class of Towns." Mr. Wilkins takes as a measure of social class the percentage of households in which the chief wage-earner has a basic wage exceeding £7 10*s.* a week, a criterion which confirms that Southend boasts a higher social status than Cheltenham or Bath! Oxford and Cambridge, it should be remarked, are rated equal, one point lower than Woking and seven behind Bournemouth. The correlation between Mr. Wilkins' criterion and such factors as the proportion of persons voting for the Conservative party at the 1950 election or the illegitimate birth-rate is interesting and surprising.

The Royal Statistical Society and, in particular, Mr. L. H. C. Tippett, who edits the journal, are to be congratulated on the excellent quality of production. If the standard of this issue should be maintained, the journal will deserve success.

N. CLARKE

"One of the responsibilities of a physicist is to publicize the truth that physics is an absorbing intellectual adventure and a worthy activity of the human mind. A physical laboratory is not a foundry where the swords of war are given a better cutting edge."

SAMUEL K. ALLISON

MEMBERS OF NOTE

Douglas Rayner Hartree, M.A., Ph.D., F.R.S. Born in Cambridge in 1897, Professor Hartree entered St. John's College in 1915 but interrupted his studies from 1916 to 1919 to serve with the Anti-Aircraft Experimental Section of the Munitions Inventions Department of the Ministry of Munitions. This group, under A. V. Hill and R. H. Fowler, also included E. A. Milne and H. W. Richmond. Returning to Cambridge and graduating in physics, Professor Hartree began experimental research on the controlled excitation of spectra by electron bombardment; he changed to full-time research in theoretical physics as a result of the stimulus of a visit to Cambridge by Niels Bohr. He applied the techniques of numerical mathematics, in which his interest had been stimulated by his work under A. V. Hill, to quantitative applications of Bohr's theory of atomic structure. Subsequently Professor Hartree developed the "self-consistent field" approximation to atomic structure in terms of wave mechanics.

After holding Research Fellowships at St. John's College and Christ's College and being a University Demonstrator in physics, Professor Hartree became Beyer Professor of Applied Mathematics in the University of Manchester in 1928, succeeding E. A. Milne. In 1937 he transferred to the newly established Chair of Theoretical Physics. It was under his direction that a differential analyser was constructed at Manchester, the first machine of its kind to be built outside the U.S.A. In 1946 Professor Hartree succeeded R. H. Fowler as Plummer Professor of Mathematical Physics in the University of Cambridge. Since then he has continued to work on the development and application of automatic digital calculating machines; for three months, in the summer of 1948, he was Acting Chief of the Institute of Numerical Analysis, a section of the U.S. Bureau of Standards. Professor Hartree regards himself primarily as a physicist, with a particular interest in mathematics as a tool in research in physics and engineering. Outside his scientific work his chief interests are music (he plays with the Cambridge Philharmonic Society's orchestra) and railways.

Professor Hartree was elected to Fellowship of the Royal Society in 1932. He became a Fellow of the Institute in 1937 and served on the Board, as Chairman of the Manchester and District Branch, in 1945–46. He is a Member of the Institution of Electrical Engineers.

Oliver William Humphreys, B.Sc. Holding one of the most responsible posts in industrial research, Mr. Humphreys is not yet 50 years of age. He studied at University College, London, and graduated in physics in 1925. In July of that year he joined the scientific staff of the Research Laboratories of The General Electric Co. Ltd., and has remained with the firm ever since. Mr. Humphreys became a Group Leader in 1927 and during the war acted as Assistant Director with general responsibility for administration. On the death of Sir Clifford Paterson in 1949, he was appointed Manager of the G.E.C. Research Laboratories and in 1951 became Director. He serves on many outside bodies including the Councils of the Electrical Research Association, the British Non-Ferrous Metals Research Association and the Institution of Electrical Engineers. He is chairman of the Telecommunications Industry Committee of the British Standards Institution and a member of its Engineering Divisional Council. He has also been a Manager of the Royal Institution.

A Fellow of the Institute since 1942, Mr. Humphreys was elected to the Board in 1951 and has recently been elected a Vice-President to take office in October next. He is also a Member of the Institution of Electrical Engineers.

NEWS OF MEMBERS

The following appointments have been notified:

Fellows

P. Savic—Assistant Research Officer, National Research Council of Canada.

J. M. Somerville—(New England University College, Australia)—Department of Physics, University College of Swansea for one year.

Associates

I. P. Bell—Senior Scientific Officer, Metallurgical Laboratories, Ministry of Supply, Culcheth, Nr. Warrington.

J. P. Henderson—Assistant Director of the East African Meteorological Department, Nairobi, Kenya, East Africa.

J. McMillan—Physicist, Imperial Chemical Industries Ltd., Central Instrument Section, The Frythe, Welwyn, Herts.

I. Watt—Research Assistant, British Scientific Instrument Research Association, Elmstead Woods, Chislehurst, Kent.

Graduates

F. P. Chappel—Research Assistant, Physics Department, University of Leeds.

J. E. Geake—Assistant Lecturer in Physics, University of Manchester.

M. W. Tulett—Aluminium Laboratories Ltd., Banbury, Oxon.

CORRESPONDENCE

Gadget Wanted

I have seen at a conference a tower with coloured lights, to signal to the speakers, on the analogy of traffic lights. This leaves the timing of talks to the Chairman's discretion, and keeps the audience informed of the Chairman's intentions as well as warning the speaker of when he is expected to stop.

But for a forthcoming conference I want a signal to speakers which is more discreet than a warning light and more informative than a clock at the back of the hall. The basis for this might well be one of the clockwork timers used by radiographers, which is pre-set to the proper length of development and then rings a bell at the end. Since the hand moves round towards zero time one can see at a glance how much time remains, without doing mental arithmetic during the lecture. But we do not need an audible signal, it would be quite enough to light up a red lamp on reaching zero. In case the speaker should not notice this red lamp, a series switch could be provided by which the chairman could flash the lamp on and off, since a flickering light is much harder to ignore than a steady one. Also such a series lamp would give a chairman the chance to postpone the lighting-up of the red lamp if the audience were evidently enthralled, even when the proper stopping time had been reached.

The timer should be portable, so that it could be placed on a reading desk, and preferably battery-operated so as to be independent of mains supplies with odd sockets. Only about three yards of flex to reach from the desk to the chairman's seat is needed. If clockwork, it should not tick very loudly.

It is to be hoped that the timer would be the property of The Institute of Physics, available for any Group, but in the first place it is wanted for the Industrial Spectroscopy Group on September 1st. Please send offers to me at 47 Belgrave Square, London, S.W.1.

ERNEST VAN SOMEREN

THE REGISTER

ELECTIONS TO MEMBERSHIP

An asterisk (*) indicates transfer from another grade.

Fellows

*Booth, Andrew Donald, D.Sc., Ph.D., Director of Electronics Computor Project, Birkbeck College Research Laboratories, London.
Brown, Thomas Walter Falconer, D.Sc., A.R.T.C., S.M., Research Director, The Parsons and Marine Engineering Turbine Research and Development Association, Wallsend.
Deutsch, Karl, Ph.D., Dipl. Ing., Physicist, Imperial Chemical Industries Ltd., Plastics Division, Welwyn.
*Meredith, Reginald, M.Sc., Senior Research Officer, British Cotton Industry Research Association, Manchester.
*Peiser, Herbert Steffen, B.A., Assistant Research Manager, Hadfields Limited, Sheffield.
*Savage, John, B.Sc., Deputy Head of Physics Department, British Iron and Steel Research Association, London.

Associates

Bovey, Fred, M.Sc., Head of Department of Science, The Technical College, Reading.
*Brown, Walter Spenceley, B.Sc., Lecturer in Physics, The Chance Technical College.
Degen, Peter Louis, B.Sc., Physicist, The Plessey Co. Ltd., Ilford.
Fonda, Albert, B.Sc., Ph.D., Assistant Lecturer in Applied Mathematics, University College, London.
Godwin, Norman Frank, B.Sc., Scientific Officer, Fighting Vehicle Design Establishment, Ministry of Supply, Chertsey.
*Guest, Stephen, B.Sc., Research Assistant, Ferranti Ltd., Edinburgh.
Morrison, John Peter, B.Sc., Research Physicist, British Nylon Spinners Ltd., Pontypool.
Rhodes, Rene George, B.A., M.S., Ph.D., Research Physicist, Associated Electrical Industries Ltd., Aldermaston.
Sheppard, Norman, B.A., Ph.D., Spectroscopic Research, Department of Colloid Science, Cambridge.
Thomas, Edward Douglas, B.Sc., Lecturer in Mathematics and Physics, Burnley Municipal Technical College.
*Williams, Charles Edington, B.Sc., Scientific Staff, Research Laboratories, General Electric Co. Ltd., Wembley.

Graduates

Ashton, Thomas, B.Sc., Assistant Physicist, Christie Hospital, Manchester.
Aston, Stanley Gordon George, B.Sc., Laboratory Engineering, General Electric Co. Ltd., Coventry.
*Axson, Michael, B.Sc., Junior Research Officer, British Cotton Industry Research Association, Manchester.
*Baker, Thomas Wilfred, B.Sc., Experimental Officer, Atomic Energy Research Establishment, Harwell.
Bromiley, Jack Vickers, B.Sc., Shop Manager, Ministry of Supply.
Brown, Kenneth Leslie, B.Sc., Test Engineer, The Fairey Aviation Co. Ltd., London.
*Comerford, Francis Maurice, B.Sc., Scientific Officer, British Iron and Steel Research Association, London.
*Freeman, Reginald Lionel, B.Sc., Instructor Lieutenant, Royal Navy.
*Hawkes, Leonard Frank, B.Sc., Physicist, Mullard Electronic Research Laboratory, Salford.
*Hayes, Roy, B.Sc., A.R.C.S., Physicist, British Resin Products Ltd., Barry.
Iles, Peter Albert, M.Sc., Physicist, Beacon Radio Ltd., New Zealand.
*Little, John, B.Sc., Assistant Lecturer, Department of Natural Philosophy, University of Edinburgh.
*Loftus, Peter, B.A., Technical Assistant, Osram-General Electric Co. Ltd., Hammersmith.
Morley, Frederick, B.Sc., Shop Manager, Division of Atomic Energy, Ministry of Supply, Salwick.
Muller, Jean, Physics Department, Federal Institute of Technology, Zurich.
Peckover, Peter Albert, B.Sc., Assistant Lecturer, Science and Related Mathematics Department, Aston Technical College.
Ranger, Alan Edgar, B.Sc., Scientific Officer, British Iron and Steel Research Association, Sheffield.
Rennie, Alison Enid, B.A., Scientific Officer, Ministry of Supply, Gt. Malvern.
Robinson, Brian John, B.Sc., Research Student, University of Sydney.
Sandifer, Eric Gerald, B.Sc., Junior Physicist, The British Thomson-Houston Co. Ltd., Rugby.
Sibbald, David, B.Sc., Physicist, Standard Telephones and Cable Ltd., New Southgate.
Sims, George Clifford, B.Sc., Senior Science Master, Secondary Technical School, The Royal Technical College, Salford.
Tweedy, John Noel, B.Sc., Shop Manager (Health Physics), Ministry of Supply, Sellafield.
Weinberg, Felix, B.Sc., Research Assistant, Department of Chemical Technology, Imperial College, London.

Subscribers

Davies, David Reginald, Research Assistant, Crystallography Department, University Museum, Oxford.
Francis, William Alfred Leslie, Leading Radiographer, Naval Construction Department, Admiralty.
Willitts, Nita, Principal of Independent Boarding School.

Students

Bates, J. M., University of Glasgow.
Ferris, P. A., Swansea Technical College.
Ogwo, S. M. I., University College, Ibadan.
Prince, J. N., Chelsea Polytechnic.
Sayers, J. F., Northampton Polytechnic
Smith, R. W., Acton Technical College.

APPOINTMENTS VACANT

Herring Industry Board require honours **graduate** in physics or related field to work in Aberdeen on problems of smoking and drying of fish, including investigation of the physical properties of smoke and of the diffusion of water in fish. Successful candidate will be required to design apparatus for measurement and control of variables involved and ultimately to apply results to industry. For terms of employment apply Secretary, 1 Glenfinlas Street, Edinburgh 3.

Electronic Research and Development Engineers and **Physicists.** Applications are invited by an old established London firm of repute for:—

1. Two senior posts of a highly interesting nature with scope for individual work and advancement.
2. One junior post.
3. One draughtsman with electrical design experience.

A first or second class Honours degree in physics or electrical engineering would be an asset for the posts 1 and 2.
Applications will be treated in strict confidence.

Write, giving details of qualifications, experience and salary required, to Box No. A.V.26, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

Applications are invited by the **Ministry of Supply** for an appointment as leader of the Metal Physics Group of the Metallurgy Department, Royal Aircraft Establishment, Farnborough, Hants. Candidates must have a first or second class honours degree in physics or metallurgy, or an equivalent qualification, with at least three years' post-graduate research experience. They should be good experimentalists who have specialised in metal physics. Sound knowledge of mathematics and an interest in thermodynamics are desirable. The appointment will be graded according to age, qualifications and experience, and salary will be assessed within the inclusive ranges: Principal Scientific Officer, £1,033–£1,377 p.a. (minimum age 31). Senior Scientific Officer, £781–£980 p.a. (minimum age 26). Rates for women somewhat lower. The post is unestablished but carries benefits under F.S.S.U. Application forms obtainable from Ministry of Labour and National Service, Technical and Scientific Register (K), Almack House, 26

King Street, London, S.W.1, quoting A196/52/A. Closing date August 29, 1952.

The British Non-Ferrous Metals Research Association requires investigators to study various problems in the fabrication and use of non-ferrous materials. Qualified metallurgists, chemists and physicists are invited to apply in writing, giving details of age, qualifications and experience to the Secretary, 81–89 Euston Street, London, N.W.1.

University of Natal, Pietermaritzburg, South Africa. Applications are invited for a **Senior Lectureship in Physics.**

The salary scale is at present £600 × £25—£900 for men and £550 × £25—£725 for women. There is also a temporary cost of living allowance of £320 per annum for married men and £100 per annum for single persons. A Government Commission is at present enquiring into salary scales for staffs of Universities, and improvement of scales is hoped for by 1953.

Duties commence on February 1, 1953.

Further particulars and information as to the method of application should be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, London, W.C.1.

The closing date for the receipt of applications is August 15, 1952.

National Institute for Research in Dairying (University of Reading). Applications are invited for a post in the Physics department to assist in research on the properties of dairy products. Candidates should have a first or second class honour degree in Physics and be between the age 21 and 28 years. The appointment will be in the Scientific Officer grade, salary £418 to £676 (men) or £418 to £545 (women) with superannuation under the F.S.S.U., and will be made about October 1, 1952.

Applications, stating age, qualifications, and experience and giving the names of two referees should be sent to the Secretary, N.I.R.D., Shinfield, Nr. Reading, within 14 days of the appearance of this advertisement. Quote reference 52/8.

The **English Electric Valve Company,** Chelmsford, Essex, has several attractive vacancies for graduates to undertake research and development work on vacuum tubes. Applications from graduates who have recently qualified as well as those with industrial or research experience will be considered. Please write, giving full details, quoting reference 419E to Central Personnel Services, English Electric Company Ltd., 24–30 Gillingham Street, London, S.W.1.

Physicist required by **British Welding Research Association** for work in Cambridge area initially on ultrasonics and non-destructive testing. Graduate Research experience necessary which need not be in this field. Salary £600–£900 p.a. F.S.S.U. Application to 29 Park Crescent, London, W.1.

The British Iron and Steel Research Association invites applications for two bursaries, tenable in the Chemistry Department of the Imperial College of Science and Technology, London, commencing October 1952. The value of these bursaries is £250 p.a. to £325 p.a. (plus approved fees) according to age; qualifications and residence. They are tenable normally for two years and are intended to lead to the degree of Ph.D. In one instance the research will be on "the constitution of molten silicates using viscosity techniques," and the other on "the fundamental aspects of the sorption of hydrogen by iron," Applicants should have, or have the expectation of, an honours degree in chemistry or physics. Written applications only to Personnel Officer, B.I.S.R.A., 11 Park Lane, London, W.1.

The British Iron and Steel Research Association invites applications for two bursaries tenable in the Nuffield Research Group in Extraction Metallurgy at the Royal School of Mines, London, commencing preferably on October 1, 1952, but may commence any time up to January 1, 1953. The value of the bursaries is £250 to £325 p.a. (plus approved fees) according to age, qualifications and residence. They are normally tenable for two years and are intended to lead to the degree of Ph.D. Subject of research is on the physical chemistry of high temperature equilibria involving (*a*) molten silicates and (*b*) molten iron. Applicants should have, or have the expectation of, a good honours degree in chemistry or metallurgy.

Written applications only to Personnel Office. B.I.S.R.A., 11 Park Lane, London, W.1.

Physicist or **development engineer** for research and development of X-ray and electro-medical equipment. Applicants should have a degree in physics or electrical engineering. Salary according to age, qualifications and experience. Applications should be sent to **General Radiological Limited,** 15–18 Clipstone Street, Great Portland Street, London, W.1.

Northern Polytechnic, Holloway, London, N.7. The Governing Body invite immediate applications for appointment as full-time **Assistant Lecturer** in the Physics Department. Burnham Technical Scale salary, Grade B plus London allowance. Forms of application, together with full particulars, will be forwarded on receipt of a stamped addressed foolscap envelope.

Physicist required as an investigator in Physics Department engaged on problems in metal physics. University degree essential. Previous experience in research or industry an advantage; upper age limit 30 years. The post carries superannuation. Application, stating salary required, to be sent to the Director of Research, **Aluminium Laboratories Limited,** Banbury, Oxon.

Applications are invited by the **Ministry of Supply** from **Physicists** and **Engineers** for appointments in the grade of Principal Scientific Officer and Senior Scientific Officer at London Headquarters for work concerned with the development of guidance and control systems and the applications of specialist techniques including radio, radar and electronics to such systems. Experience in the development of auto pilots and servo-mechanisms is desirable. Candidates should have a 1st or 2nd class Honours degree or equivalent in Physics or Engineering followed by at least three years' research experience. Salary and grade will be assessed according to qualifications and experience within the inclusive ranges: P.S.O. (minimum age 31), £1,075–£1,459 per annum, male. S.S.O. (minimum age 26), £812–£1,022 per annum, male. Rates for women somewhat lower. The posts are unestablished but carry F.S.S.U. benefits. Application forms obtainable from Ministry of Labour and National Service, Technical and Scientific Register (K), Almack House, 26–28 King Street, London, S.W.1, quoting A.206/52A. Closing date 24th September, 1952.

The British Coal Utilisation Research Association. Applications are invited from honours graduates in Physics or Engineering for two posts as Scientific Officers in the Physics Department for work on problems in the fields of (*a*) heat transfer and (*b*) particle mechanics, which includes the properties and behaviour of dust particles. In both cases the work will involve fundamental studies and investigations on industrial and pilot plant scale. Successful applicants will commence within the salary range £450–£600 per annum depending on age, qualifications and experience, with superannuation benefits under the F.S.S.U. Some aptitude for electronics would be useful for one of the posts. Apply in writing to the Assistant Secretary, B.C.U.R.A., Reference A.16, Randalls Road, Leatherhead.

Mid-Essex Technical College, Market Road, Chelmsford. Applications are invited for following posts: (*a*) **Senior Laboratory Steward** (Science), (*b*) **Laboratory Steward** (Physics). Salary scales: (*a*) £400 × £15–£470; (*b*) £310 × £15–£415. Further particulars and application form from the Clerk to the Governors.

The Research and Development Division of the **British Steelfounders' Association** invite applications from **Experimental Physicists** or **Chemists,** preferably of graduate standard, for laboratory and field research related to industrial dusts, their formation, sampling, and properties. Appointment will carry Scientific Officer status and will be superannuable. Salary level from £600 per annum, depending upon experience and qualifications. Applications will be treated as confidential and should be addressed to the Director of Research, British Steel Founders' Association, Broomgrove Lodge, Sheffield 10.

National Coal Board. Applications are invited for the appointment in the Central Research Establishment at Stoke Orchard, Nr. Cheltenham, of a **Physicist** with a good honours degree for laboratory investigations on the briquetting of coal and allied materials. Previous research experience is desirable. The appointment, which is superannuable, will be in the grade of Scientist II (salary scale £645 × £30 to £1,095 male, and £545 × £25 to £795 × £30 to £945 female), the starting salary depending on qualifications and experience.

Apply in writing, giving full particulars (in chronological order) of age, education, qualifications and experience (with dates) to National Coal Board, Establishments (Personnel) Hobart House, Grosvenor Place, London, S.W.1, marking envelope TT/506. Original testimonials should *NOT* be forwarded. Closing date September 10, 1952.

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